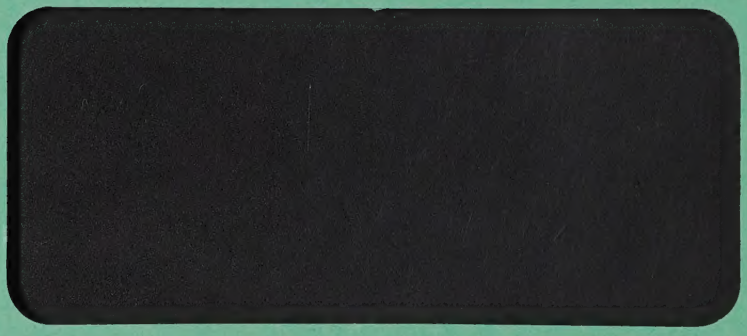
WAYNE KERR

Source/Detector

SR268

Maintenance Manual



Source/Detector

SR268

Maintenance Manual

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INTRODUCTION

The method of using the SR268, and its relationship with other instruments, are dealt with in the Operating Instructions supplied with each instrument. This manual has been prepared for the benefit of those users who require a more detailed knowledge of the circuits used, their operation and adjustment.

A functional description of the complete instrument is given first and this is followed by detailed descriptions of the synchronous tuning system and the various circuits incorporated in the source and detector sub-units.

Complete instructions are given for setting up the internal preset controls and for adjusting the tuned circuits throughout the instrument. Though it is not anticipated that the Range and Tuning drive system should require any regular attention other than lubrication, instructions for the replacement of the drive cords are given in case of their accidental breakage or dislocation. Typical d. c. voltages are given and, finally, a complete list of electronic components.

FUNCTIONAL DESCRIPTION

Source and Detector

1 The SR268 comprises an LC oscillator, a t. r. f. receiver and a power supply unit, all of which are mounted on a common chassis assembly. The oscillator and receiver (or detector) are contained in separate totally screened compartments connected only by the mechnical drives to the tuning and range switching systems.

2 The block diagram, fig. 1, shows the progress of the signal from the oscillator to the bridge, and from the bridge to the detector and meter. The frequency range of both oscillator and detector is covered in nine bands by means of four sets of transformers, each set being carried in its own turret drum. The tuning of both oscillator and detector is described in detail in paragraphs 9 to 13 inclusive.

3 The amplitude of the oscillator output is maintained at a constant level by means of feedback, a thermistor, and diode limiters. The signal from the oscillator is fed via an emitter follower to a tuned power output stage and thence via a common-mode rejection (C. M. R.) transformer to the source output unit. This unit comprises a four-stage attenuator which is brought into circuit by means of a bank of four push-on/push-off switches. Another C. M. R. transformer is inserted between the attenuator and the source output socket. The source attenuator gives additive steps of 3, 6, 10 and 20dB attenuation.

4 The C. M. R. transformers present a low impedance to wanted signals and a high impedance to interference signals whose return path is via some route other than the C. M. R. transformer. At frequencies above 1MHz the rejection of the common mode by the C. M. R. transformers is greater than 20dB.

5 The unbalance signal from the bridge is fed back into the SR268 at the Detector socket and, from there, via a C. M. R. transformer to a four-stage attenuator similar in form and operation to that in the Source path. Each stage of the Detector Attenuator is made to cover a 20dB change in input signal level, this being the change that increases

the null meter indication from 10% to 90% of f. s. d. Another C. M. R. transformer is inserted in the signal path following the attenuator.

6 The detector input signal then passes to the first stage of a two-stage tuned amplifier. The first stage is a common-base amplifier with tuned collector; the second stage comprises a cascode pair to give adequate stability over the frequency range. The tuned networks in this amplifier are identical with their equivalents in the oscillator circuit.

7 The signal from the tuned amplifier is fed via a wide-band emitter follower to a three-stage wide-band amplifier. The amplifier comprises three identical stages, each of 20dB gain, and the overall frequency response covers the range 100kHz to 100MHz. The preceding emitter follower provides a constant current driving source while presenting a high impedance to the tuned amplifier.

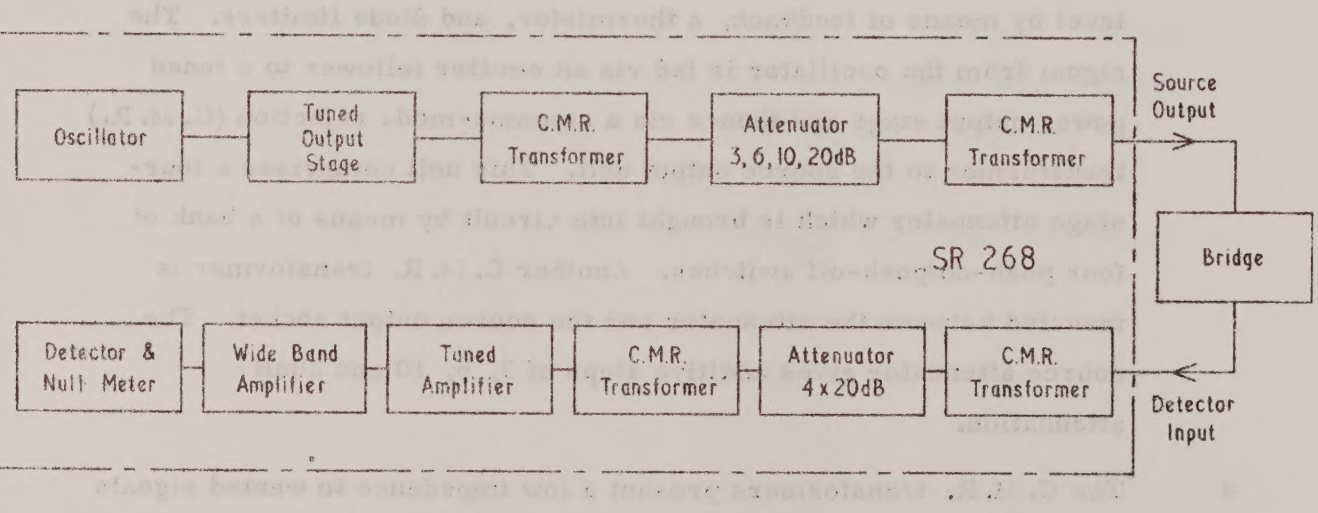


Fig. 1 Block Diagram

8 The amplified signal from the bridge is then fed to a diode detector and filter network from which is obtained the d. c. signal that drives the null meter. The law of the meter is adjusted to give a deflection from 10% to 90% when the input signal increases by 20dB.

Tuning System

9 On each range, the four tuned circuits - two in the oscillator and two in the detector - are similar so as to facilitate the synchronous tuning of source and detector over the full frequency range. In each case, the tuned winding forms part of a transformer which has two other windings, one for the collector circuit and one for the base circuit of the following stage. Although the tuned winding on all the transformers for a given range are identical, the remaining two windings on each differ slightly between the transformers. This arrangement allows the requirements of the tuned circuit, the generator and the load to be individually met. Full information for all transformers is tabulated in Table 1. The frequency ratio for each range is $\sqrt[3]{10}$ and, for the lower five ranges, the coil Q is inversely proportional to frequency so as to give a constant gain over the range. Other considerations (e. g. transistor parameters) preclude this over the higher ranges.

10 All four transformers are changed for each range and for this purpose they are mounted in four turret drums, nine transformers per drum, the turrets being ganged and operated by the Range switch. The use of turrets for the transformer mountings ensures a constant geometrical layout for each range. Each transformer has a tuning slug to adjust the inductance, and a small trimmer capacitor to control the total stray capacitance. These components are mounted on a small printed circuit board in which is incorporated the set of six contacts which carry the transformer connections into the main assemblies.

11 The shaft carrying the turret assembly is mounted in ball-race journals and rotated by a geared drive from the Range control as shown in fig. 7; this is also coupled by means of a sprocket drive to the switch S3 which selects the appropriate scale and scale multiplier lamps. To avoid unwanted coupling via the drive shaft between the Source and Detector turrets, a nylon heavy-duty coupler is inserted midway along the shaft.

12 The main tuning control drives the ganged tuning capacitors for the oscillator, its power output stage, and the two stages of the detector tuned amplifier. Since both sides of all four tuning capacitors must

TABLE 1

SR268 Coil Information

T = Tuned C = Collector B = Base

Range	Inductance	Make	Type No.	Stage	Turns T	Turns C	Turns B	Gauge T	Gauge C	Gauge B	Type
1	28.7mH	Mullard 18mm	Core LA 2506 Bobbin DT 2281	A B C D	444 444 444 444	33 30 18 44	4 4 3 28	44e.c.s/f	"	"	4 sections, 2 in each 1/2 of bobbin. Random Wound.
2	6.2mH	Mullard 18mm	Core LA 2506 Bobbin DT 2281	A B C D	207 207 207 207	23 20 12 14	3 3 2 9	42e.c.s/f	" 38	" 38	as 1
3	1.33mH	Mullard 18mm	Core LA 2506 Bobbin DT 2281	A B C D	96 96 96 96	15 14 12 9	2 2 2 6	42e.c.s/f	" 38	" 38	as 1 but keep to <u>outer edges</u>
4	287µH	Mullard 18mm	Core LA 2506 Bobbin DT 2281	A B C D	45 45 45 45	11 9 6 6	2 2 1 1	38e.c.s/f	"	"	as 1
5	62µH	Mullard 18mm	Core LA 2550 Bobbin DT 2281	A B C D	26 26 26 26	8 7 6 6	1 1 1 1	36e.c.s/f	"	"	1/2 turns on each section of bobbin. Random Wound.
6	13.3µH	Mullard 18mm	Core LA 2552 Bobbin DT 2281	A B C D	16 16 16 16	7 6 6 5	1 1 1 3	9/46 litz s/f	36e.c.s/f "	" 36	as 5
7	2.87µH	Cambion	2191.6.5	A B C D	23 23 23 23	11 10 9 10	2 2 2 7	36e.c.s/f	" 33	" 33	Closewound layer at base end of former
8	0.62µH	Cambion	2191.6.5	A B C D	10 10 10 10	7 6 4 5	2 2 1 3	28e.c.s/f	"	"	as 7
9	0.133µH	Cambion	2175.7.5	A B C D	4 4 4 4	2 2 2 3	2 3 1 2	21e.c.s/f	" 44	" 44	Open-wound length = 3/8 o.d. over C & B

e. c. s/f = enamelled copper self-fluxing

of winding Coll.	Base (out)	Remarks
Random wound over last section of T.	Random wound over C	
as 1	as 1	
as 1	as 1	
as 1	as 1	
as 1	as 1	
as 1	as 1	
Close wound layer over T. Space in centre for B.	Close wound layer over T in gap in centre of C.	Keep bottom of T close to former base.
as 7	as 7	as 7
Close wound adjacent to B.	Close wound adjacent to C.	Keep bottom of T close to former base. C & B 1/2 way down along length of T.

be isolated, the moving vane drive spindles are coupled together by means of nylon couplers. These couplers incorporate a metal disc screen so as to reduce any unwanted electrostatic coupling between the capacitors. The disc screen between the Source and Detector tuning capacitors is larger and is connected to chassis by means of a pair of beryllium copper brushes.

13 The geared drive between the Tuning control and the tuning capacitors also operates the sprocket drive that carries the illuminated pointer to and fro across the frequency scale. The pointer comprises a metal box which is divided into three light-tight sections, each section straddling one of the three scales. Into each section of the pointer box is inserted a miniature pea lamp bulb whose light shines through a vertical slit at the front of the box and is viewed through the clear strip running the length of each scale. The lamps are connected via a flexible cable to switch S3C, the appropriate lamp being illuminated according to the setting of the Range switch.

CIRCUIT DESCRIPTION

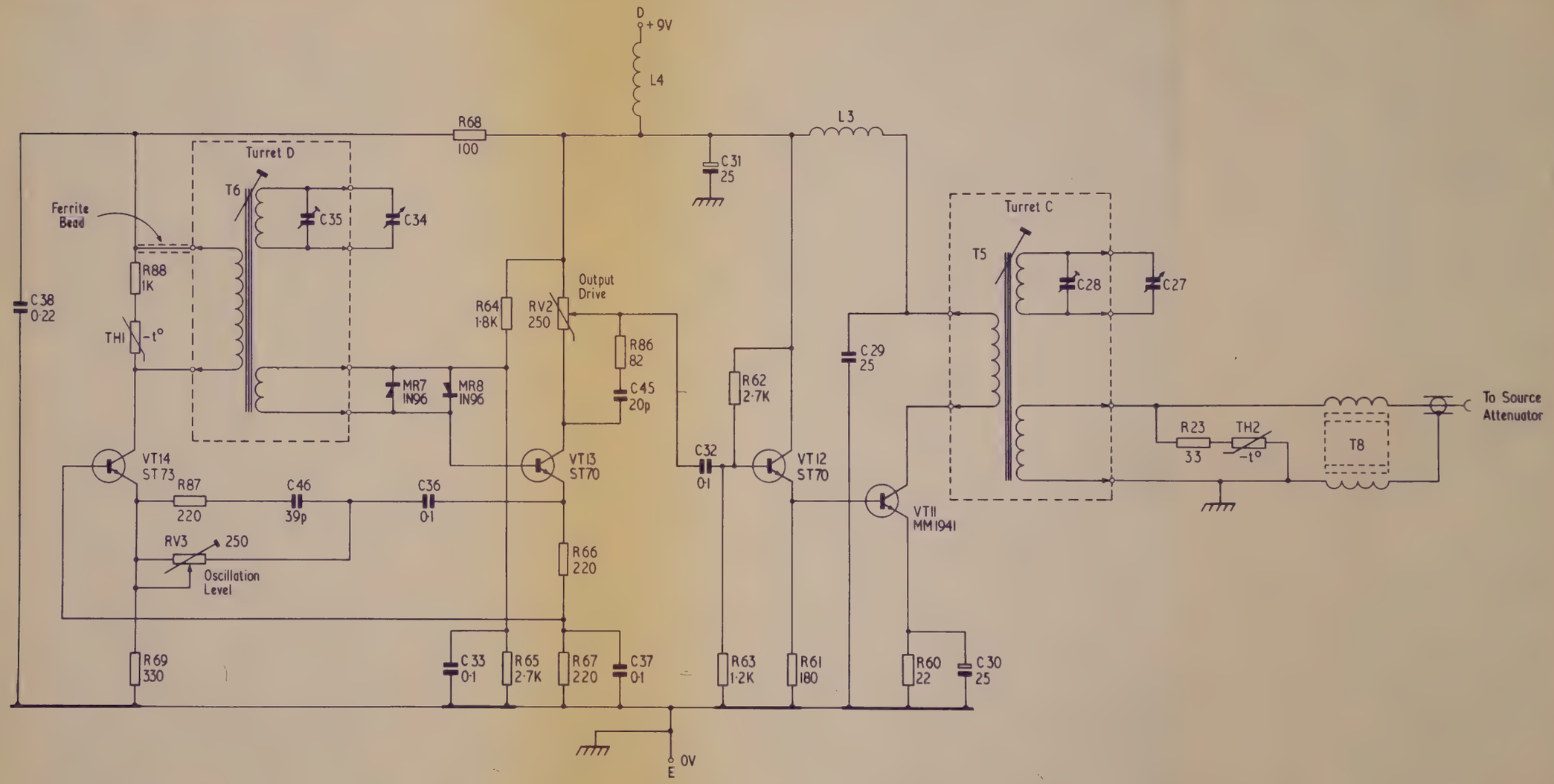
SOURCE

14 The complete circuit diagram of the Source is given in fig. 2. It comprises the oscillator VT14, a wide-band amplifier stage VT13, an emitter follower driver stage VT12 and a tuned power output stage VT11.

Oscillator and Wide-Band Amplifier

15 The oscillator transistor VT14 operates in the common base mode. The output is fed directly to the wide-band stage VT13 so as to minimise the loading of the oscillator by the feedback network and the driver stage. The feedback is taken from the emitter of VT13 via the network RV3, R87 and C46, and this controls the initial loop gain. Capacitor C36 provides d. c. isolation in the feedback loop. Resistors R66 and R67 determine the direct current in VT13, and the decoupled voltage across R67 provides the d. c. potential for the base of VT14. Potentiometer RV3 is adjusted to give the correct loop gain consistent with acceptable distortion; R87 and C46 compensate the loop gain above 50MHz.

R	88 69 87 68 64 65 66 67 86 63 62 61 60 23	R
C	38 46 35 34 36 33 45 37 31 32 29 30 28 27	C
Misc	VT14 TH1 RV3 T6 MR7 MR8 RV2 VT13 L4 VT12 L3 VT11 T5 TH2 T8	Misc



Oscillator Circuit Fig 2

16 The stability of the output level and the actual loop gain are determined by MR7, MR8, R88 and TH1. The low capacity diodes MR7 and MR8 clamp the oscillator output voltage at approximately 1.2V p-p at the base of VT13. Thermistor TH1 and resistor R88 give loop gain adjustment with a time constant of approximately 3 to 4 seconds and this allows the oscillator to stabilize with low distortion at the clamped voltage. The d. c. bias for the base of VT13 is determined by resistors R64 and R65.

17 Capacitor C35, in parallel with the tuned winding of T6, is the small trimmer capacitor referred to in para. 10; this forms part of the transformer assembly and is changed for each range. The ferrite bead on the lead to the collector winding of T6 prevents high frequency parasitic oscillation which might otherwise occur owing to the necessarily long leads into and out of the coil turret.

Driver and Power Output Stages

18 The output from VT13 is taken from the slider of RV2, its collector load, via C32 to the base of the emitter follower driver stage VT12. The network R86 and C45 effectively increases the input to VT12 at frequencies above 50MHz and this compensates for the fall in power gain of the output amplifier.

19 The output from the emitter of VT12 is coupled directly to the base of VT11. The tuned winding of the transformer T5 has a trimmer capacitor C28 connected in parallel; this component is changed with the range as mentioned in paragraph 10. The output stage is designed to operate into a 75Ω load but, since the load offered by a bridge can vary between 40Ω and 400Ω or more, the stage may be required to operate into the near-equivalent of an open circuit. Without due precautions, this would cause excessive distortion of the output waveform. The resistor R23 and thermistor TH2 behave as a variable load and limit the voltage rise on open circuit to approximately 20% above the level that exists with a 75Ω load. The distortion is thus kept within an acceptable limit. C29, C38, L3 and L4 are decoupling components.

20 The output from T5 is taken via a C. M. R. transformer T8 to the Source

attenuator and thence, via another C. M. R. transformer T4, to the Source output socket on the front panel. The circuit diagram of the Source Attenuator is given in fig. 3.

DETECTOR

21 The Detector Attenuator comprises four identical stages each giving an attenuation of 20dB. The circuit diagram of a typical stage is given in fig. 3.

22 The Detector comprises the tuned amplifier VT1, VT2 and VT3, a wide-band emitter follower VT4, three identical amplifier stages VT5/VT6, VT7/VT8, VT9/VT10 and, finally, the null meter and its associated filter network. The circuit diagram is given in fig. 4 but, for clarity, only one of the amplifier stages (VT5/VT6) is shown.

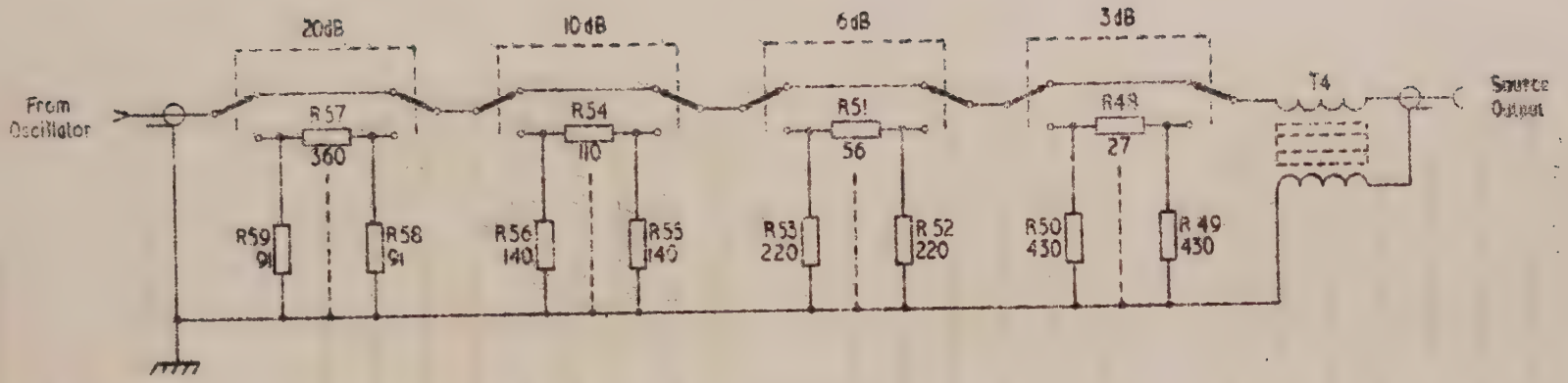
Tuned Amplifier

23 Transistor VT1 is a straightforward common-base amplifier having a wide-band 75Ω input and a tuned collector. The collector current is reduced to 0.3mA so as to obtain the required input impedance. The second stage of the tuned amplifier comprises the cascode pair VT2 and VT3. The high stability of this stage stems from the low feedback capacity of VT3 - approximately 1pF - which is further reduced by the reverse voltage action of VT2. The d. c. bias for the stage is obtained from the network R18 to R21 and R22. Capacitor C50 and resistor R91 are anti-parasitic components.

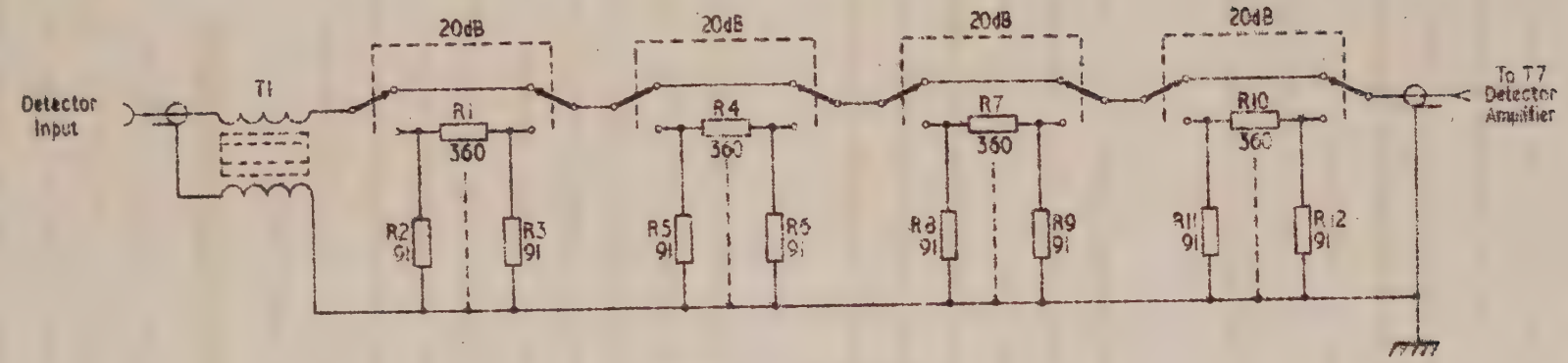
24 The diodes MR1 and MR2 across the output winding of T3 restrict the output of the tuned amplifier and so reduce overloading of the video amplifier if an unduly large input is inadvertently fed into the Detector. The overall voltage gain of the tuned amplifier between the input of VT1 and the input of VT4 is 59dB at frequencies below 3MHz.

Wide-Band Amplifier

25 Transistor VT4 is a wide-band emitter follower which provides both a constant current source, via R29, for the succeeding amplifiers, and a high impedance load for the tuned amplifier. Resistor R29 is used as a preset gain control, its value being selected during manufacture.



Source Attenuator



Detector Attenuator

Source & Detector Attenuators Fig. 3

26 The three stages of the wide-band amplifier are identical series-parallel feedback pairs whose gain is determined by the ratio of the feedback and emitter resistances. In each pair, the feedback resistor (e. g. R30) is 1kΩ and the emitter resistor (e. g. R34) is 100Ω; thus the ratio is 10 times, giving a gain of 20dB. So as not to upset this feedback ratio, the ratio of output to input impedance for each pair is made high. Negative shunt feedback gives a low input impedance of approximately 10Ω in this case and the output impedance - determined by the collector load of the second transistor - is made 390Ω to give the relatively high ratio of 39:1. Capacitors C43 and C44 adjust the frequency response of the amplifier.

Meter Circuit

27 The output from the last feedback pair VT9/VT10, is fed via C23 to the diode detector circuit comprising MR3, MR4 and R27. The h. f. ripple is filtered by the network R46, L2, C22, C25 and C26. The diodes MR5 and MR6 are d. c. shaping diodes whose effectiveness is adjusted by means of RV1 to give the required scale shape on the null meter. The value of R47 is selected according to individual instrument requirements.

POWER SUPPLY UNIT

28 The Power Supply Unit comprises two separate series stabilized circuits each of which provides an output of +9V with respect to the 0V line. The use of separate supplies obviates the risk of source-to-detector coupling via the common impedance of a single supply line. Apart from the common power input transformer T9, the two stabilizer circuits are identical and that for the Source is given in fig. 5. The operating principles of a series stabilizer circuit are too well known to require elaboration here. Resistor R83 (R75 in the Detector power supply) is adjusted during manufacture to give an output of exactly 9V. For convenience, the indicator lamps are included with the power supply in fig. 5.

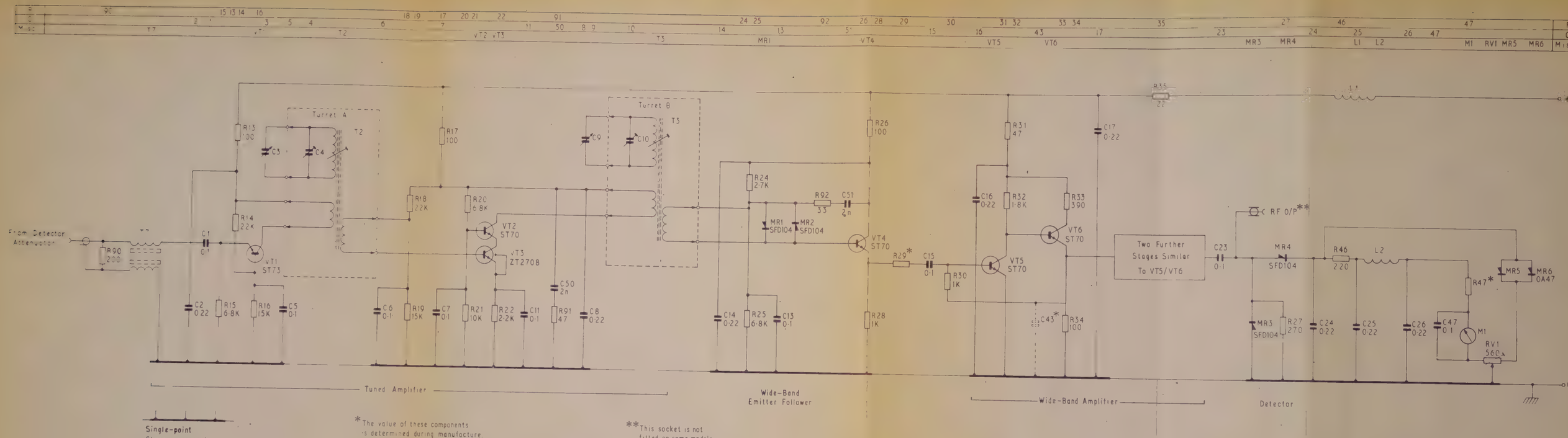
SETTING-UP INSTRUCTIONS

29 Apart from the components associated with the tuning system, there are only three preset adjustments in the SR268. These are

RV1 - which controls the law of the null meter

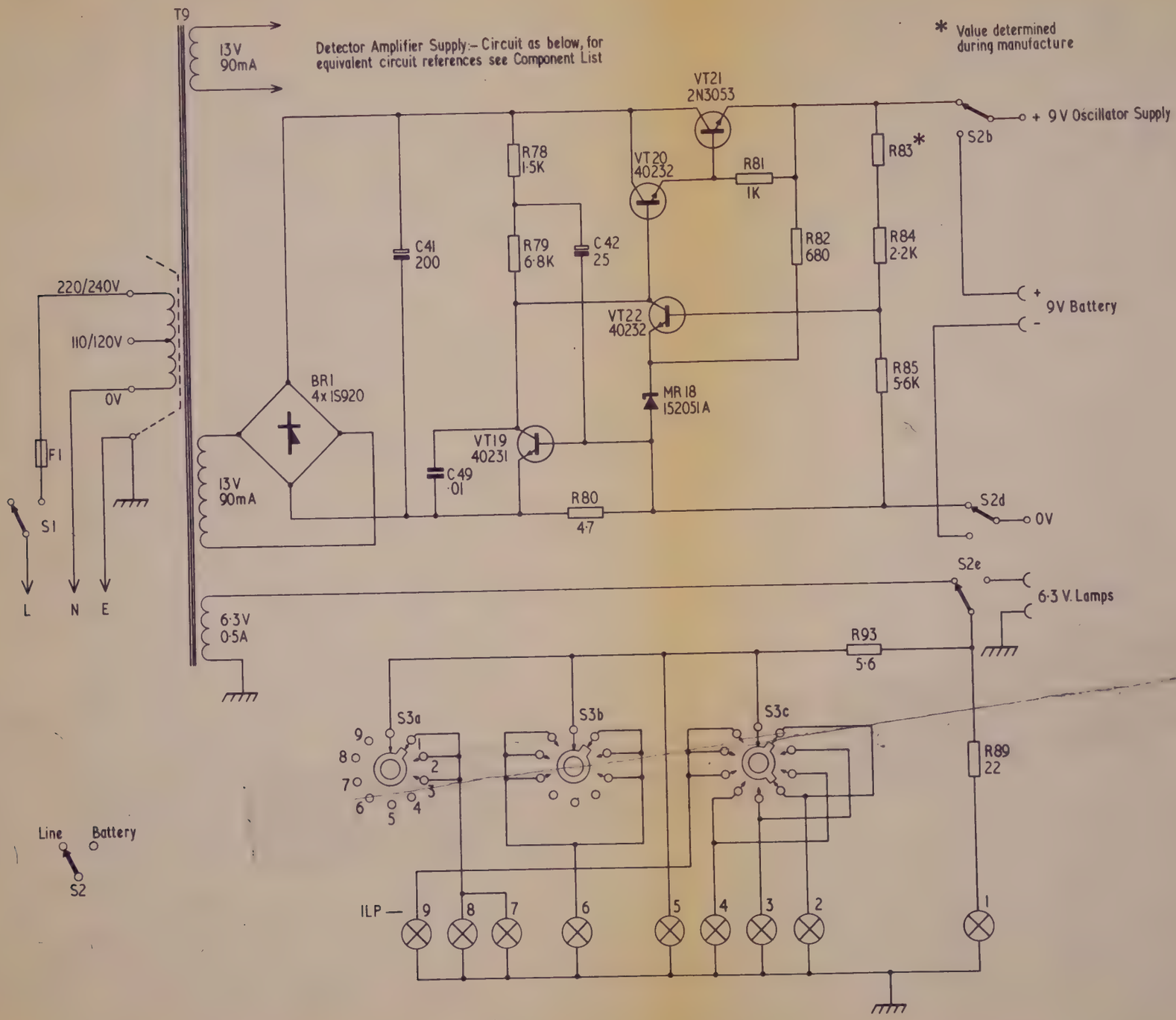
RV2 - which controls the oscillator output drive level

RV3 - which controls the oscillator feedback.



Detector Circuit Fig. 4

R	78 79 80 81 82 83 84 85 93 89	R
C	41 49 42	C
Misc	F1 S1 S2 T9 BR1 S3a VT19 S3b MR18 VT20 VT22 VT21 S3c S2b S2d S2e	Misc



Power Supply Circuit. Fig. 5.

In general, the alignment procedure is to set up the oscillator output level and frequency against external instruments and then to tune the detector to its own source.

30 The outer cover must be removed before any setting-up operations can be commenced. Stand the instrument face downwards on the bench. Release the four quick-release fasteners on the rear face of the cover by giving each a quarter-turn. Lift the cover clear of the instrument. Notice that the chassis tray has two cut-outs through which can be seen the tuning coil assemblies in the turret drums. Take care that these are not damaged by tools or loose components when the instrument is placed bottom downwards on the bench.

Test Equipment Required

31 The following items of test equipment are required for the calibration of the instrument.

(1) Valve-voltmeter to indicate up to 3V rms at frequencies up to 100MHz.

(2) Oscilloscope to view frequencies of at least 100MHz and preferably with calibrated timebase and Y-amplifier.

(3) Digital counter to indicate frequency up to 100MHz to 1% accuracy.

(4) Step attenuator, 75Ω, covering at least 100dB and capable of operating at frequencies up to 100MHz.

(5) Signal generator covering the frequency range 100kHz to 100MHz.

Oscillator Frequency Adjustment

32 Disconnect the miniature plug that feeds the d. c. supply to the detector amplifier (right-hand side as viewed from the front). Remove the two metal covers from the oscillator printed-circuit boards and turrets. Set both RV2 and RV3 to approximately mid-position. Connect the oscilloscope to the Source output socket on the front panel; all the Source attenuator buttons should be disengaged (i. e. in the 'out' position).

33 Adjust the oscillator feedback control RV3 to give satisfactory oscillation with minimum distortion over all frequency bands. Then, with the oscillator set to 1MHz on Range 4, adjust RV2 to give 6.3V p-p into 75Ω. At this stage, it may be necessary to adopt compromise settings for RV2 and RV3 to ensure oscillation over the higher frequency ranges.

34 Connect the oscillator output to the Frequency Counter and set both to cover range 1 (100kHz to 210kHz). Set the SR268 Tuning control to 100kHz and adjust the core of T6 until the oscillator frequency is between the limits 99.5kHz and 100.5kHz. Set the Tuning control to 210kHz and adjust the trimmer capacitor C35 until the frequency is between the limits 209kHz and 211kHz. If the range of C35 is insufficient to achieve this, a fixed capacitor can be added in parallel on ranges 7, 8 and 9, and in series or parallel on ranges 1 to 6 inclusive. Figure 7 shows how the coil assemblies are mounted and figure 6 shows the r.f. transformer p-c boards and the method of connecting an extra capacitor in series or parallel. Set the Tuning control to 100kHz and check the oscillator frequency, re-adjusting the core if necessary.

35 When the adjustment of T6 and C35 is completed, the oscillator output transformer T5 and trimmer capacitor C28 should be adjusted for maximum oscillator output, T5 being set at 100kHz and C28 at 210kHz. Each adjustment should be repeated until no further increase in output can be obtained. If necessary, additional capacitance can be added to C28 in the same manner as that described for C35 in the previous paragraph.

36 The transformers and their associated trimmer capacitors for the remaining frequency ranges are adjusted in a similar manner in accordance with the frequencies and limits given in Table 2 below. When all adjustments are completed, the trimmer capacitors should be sealed with a small spot of polystyrene cement.

RANGE	DIAL SETTING	ADJUST	FREQUENCY	
			Min.	Max.
1	1.00	Slug	99.5 kHz	100.5 kHz
	2.10	Trimmer	209 "	211 "
2	2.20	Slug	219 "	221 "
	4.60	Trimmer	458 "	462 "
3	4.70	Slug	468 "	472 "
	10.00	Trimmer	0.995 MHz	1.005 MHz
4	1.00	Slug	0.995 "	1.005 "
	2.10	Trimmer	2.09 "	2.11 "

RANGE	DIAL SETTING	ADJUST	FREQUENCY	
			Min.	Max.
5	2.20	Slug	2.19 MHz	2.21 MHz
	4.60	Trimmer	4.58 "	4.62 "
6	4.70	Slug	4.68 "	4.72 "
	10.00	Trimmer	9.95 "	10.05 "
7	1.00	Slug	9.95 "	10.05 "
	2.10	Trimmer	20.9 "	21.1 "
8	2.20	Slug	21.9 "	22.1 "
	4.60	Trimmer	45.8 "	46.2 "
9	4.70	Slug	46.8 "	47.2 "
	10.00	Trimmer	99.5 "	100.5 "

TABLE 2
Oscillator Trimming

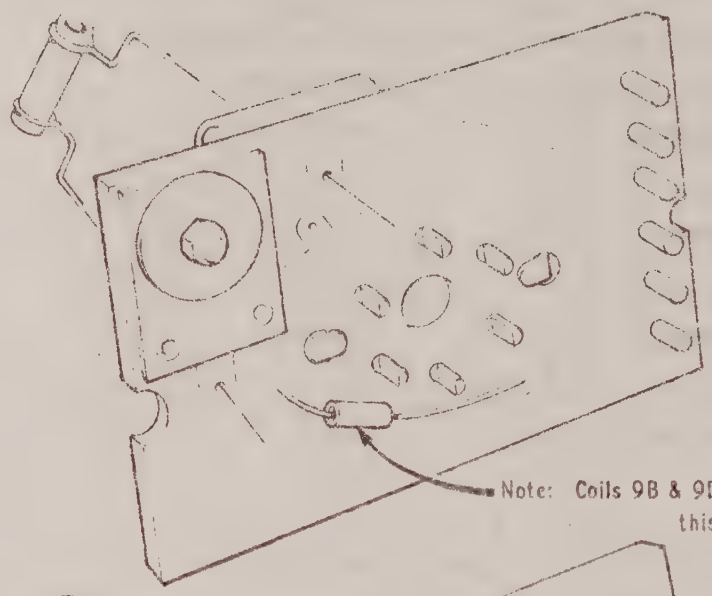
37 Disconnect the Frequency Counter and connect the oscilloscope to the Source output socket. Repeat the operation described in paragraph 33. Ensure that the spring grounding clip is correctly in place between the two turrets, then fit the two screening covers to the oscillator p-c boards and turrets. Finally, with the oscillator tuned to 1MHz on range 4, check

(a) that the oscillator output does not increase by more than 20% when the 75Ω termination is removed.

(b) that each Source attenuation step is within ±1dB of nominal.

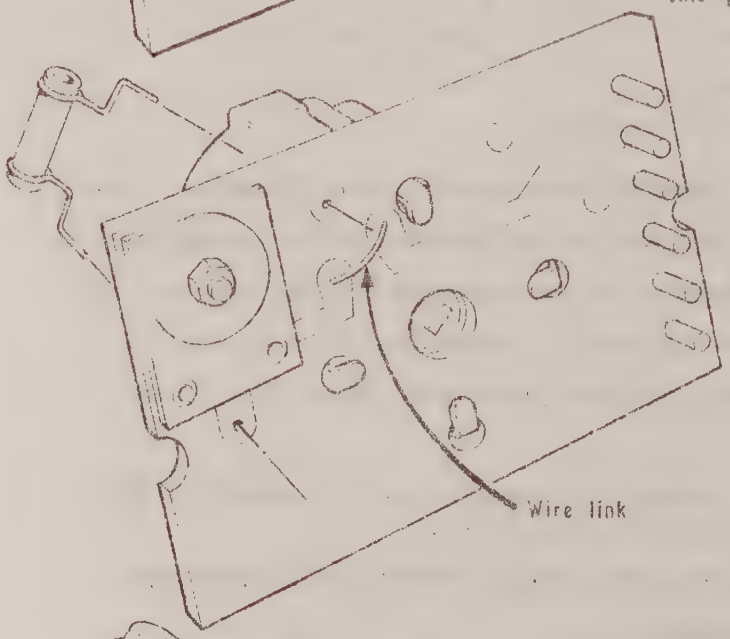
Video Amplifier Frequency Response

38 Disconnect and remove the attenuator, and disconnect the miniature d. c. supply plug from the oscillator. Set the Signal Generator frequency to 1MHz and connect its output via a 330Ω resistor to the junction of R29 and C15. Adjust the input signal level to give a null meter indication of 10% f. s. d.; this will be approximately 225μV rms. The response between 100kHz and 10MHz should be within ±1dB of the response at 1MHz. The response at 100MHz should be less than 4dB down, and, at all other frequencies between 10MHz and 100MHz, less than 6dB down on the response at 1MHz. If necessary, the frequency response can be adjusted by selecting values for C43 and C44 (approximately 6.8pF, but with a maximum of 10pF). Check the Detector Attenuator



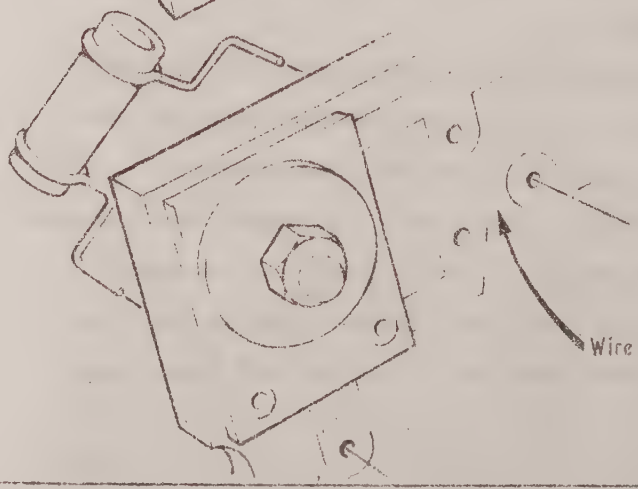
Adding fixed capacitor in parallel on ranges 7,8 or 9.

Note: Coils 9B & 9D have ferrite bead in this position



Adding fixed capacitor in parallel on ranges 1–6

Wire link



Enlarged corner of range 1–6 coils showing capacitor added in series

Wire link removed

Tuning Coil P–C Boards Fig.6

by pressing the buttons one at a time and, as each is pressed, increasing the Signal Generator output by 20dB. Each stage of the SR268 Detector Attenuator should be within ± 1dB of its nominal value.

Detector Frequency Adjustment

39 Remove the two metal covers from the detector amplifier and turret drums. Connect the miniature d. c. supply plug at the right-hand side of the amplifier. Using short 75Ω B. N. C. connector cables, connect the Source output socket to the Detector input socket via the 75Ω step attenuator.

40 Set the Range switch to the 100 - 210kHz range and the Tuning control to 100kHz. Set the attenuator controls to give an indication of approximately 10% of f. s. d. on the null meter. Tune the oscillator to 210kHz and adjust the trimmer capacitors C4 and C10 for maximum indication on the null meter. During these adjustments the attenuator should be reset as required to keep the null meter indication on scale. Tune the oscillator to 100kHz and check the adjustment of the cores of T2 and T3.

41 As with the oscillator trimmers, additional fixed capacitors can be added to C4 and C10 if their range of adjustment is insufficient. The method of connection is exactly the same as that described in paragraph 34. The detector transformers and trimmer capacitors for the remaining frequency ranges are adjusted in a similar manner and at the same frequencies, range for range, as given for the oscillator in Table 2 following para. 36. When all adjustments are completed, seal the trimmer capacitors with a small spot of polystyrene cement. Replace the covers taking care that the spring grounding clip is correctly in place.

42 If, at any stage of the adjustment of the Detector Amplifier, the null meter indication does not respond to the adjustment being made, remove the d. c. supply plug from the oscillator and note whether or not the null meter indication falls. If the indication falls to zero, it simply means that the tuning range of the adjustment is insufficient and can be dealt with as already described. However, if the null meter indication does

not fall, it suggests that the detector amplifier is self oscillating.

Meter Circuit

43 With the attenuator still connected as in para. 38, set the range switch and Tuning control for a frequency of 1MHz. Using the external and internal attenuators as necessary, establish a null meter indication of 90% of f. s. d. Increase the total attenuation by 20dB and adjust RV1 to give a null meter indication of 10% f. s. d. (The points of 10% and 90% f. s. d. are marked on the meter scale). If the range of adjustment of RV1 is insufficient to achieve this result, the value of R47 can be changed as necessary.

Overall System Gain

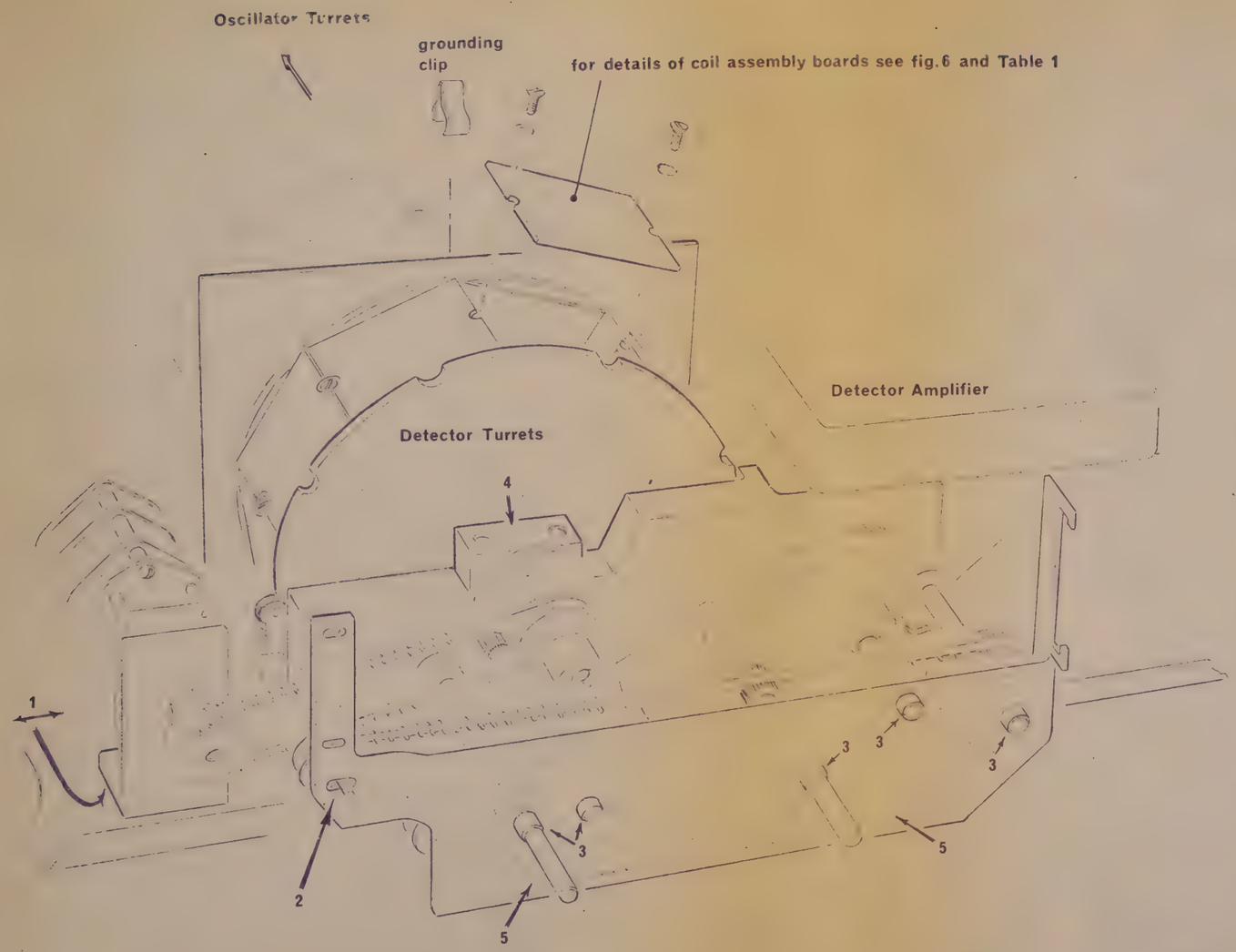
44 When all the tuning adjustments have been completed, set the frequency to 100kHz and the attenuators (both internal and external as required) to give a null meter indication of 10% f. s. d. The total attenuation in circuit should be 140 ±3dB. If this is not the case, the gain of the system should be adjusted by altering the value of R29 until the condition is achieved. However, the value of R29 should not be reduced below 100Ω.

GENERAL MAINTENANCE

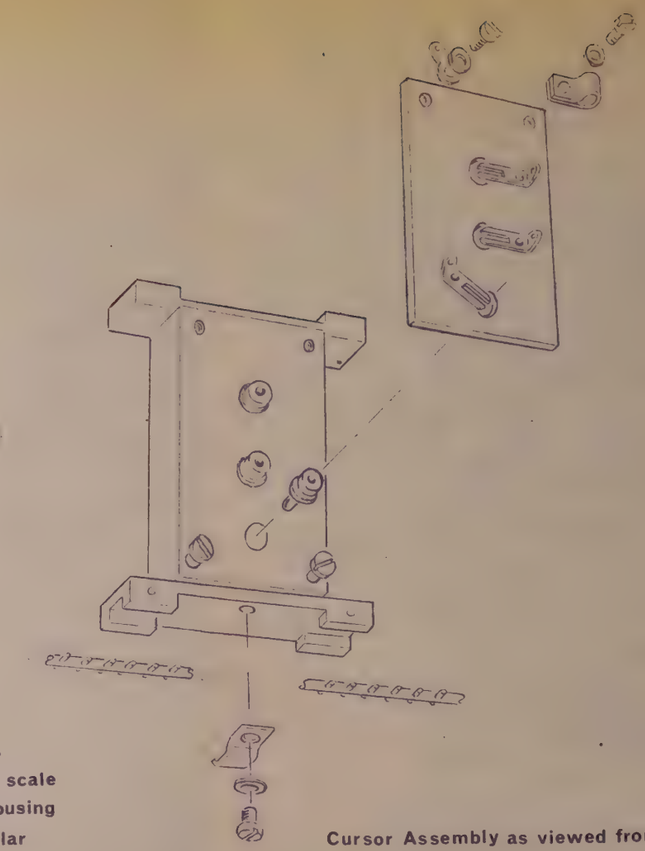
Lubrication

45 Some of the spindles in the Range switch and Tuning drive mechanism are mounted in phosphor bronze plain bearings and these require a little lubrication from time to time. It is not possible to give any guidance as to the frequency of oiling since this depends on the amount of use the instrument receives. Any good quality light machine oil is suitable but should not be used too liberally as the oil would then tend to spread and attract dust. The spindles requiring lubrication are shown in fig. 7 and the amount of oil per bearing should not exceed one or two drops such as may be carried to the bearing on a needle point.

IMPORTANT NOTE: THE FOUR BEARINGS SUPPORTING THE TUNING COIL TURRET ASSEMBLY (Reference 4 on Fig. 7) ARE FORMED FROM A SPECIAL MATERIAL AND MUST NOT BE OILED. DISREGARD OF THIS INSTRUCTION MAY IMPAIR THE PERFORMANCE OF THE INSTRUMENT.



1 Range Switch belt tension adjustment
2 Tuning Drive belt tension adjustment
3 Lubricate both bearings on these shafts as detailed in para. 45
4 DO NOT lubricate the turret bearings
5 Bearing Plate support pillars used as belt guides at these points



NOTE:
Tuning scale lamphousing is similar

Cursor Assembly as viewed from the rear

FIG. 7
Range Switch & Tuning Drive System

Range and Tuning Drive Belts

46 In the event of breakage of either of the drive belts, they can be replaced as described in the following paragraphs. The replacement of either drive belt involves the disturbance of the tuning scale and so it must be followed by a frequency check (given in para. 58) to ensure that the frequency scale is correctly aligned.

47 Range Drive Belt. Having removed the outer cover as described in para. 30, the chassis assembly must be removed from the frame as follows:

(1) Remove the four 2 B. A. Allen screws that secure the front handles (two screws per handle).

(2) Carefully withdraw the chassis through the front of the framework. In doing this, do not take the weight of the chassis on the top or bottom rails of the front panel as these are not secured after approximately 1/4-inch of forward movement of the chassis through the framework. Lift off the top and bottom front panel rails.

48 Before proceeding further, it is necessary to set the lamp switch S3 to the correct position relative to the range turret. Remove the screening cover from the Detector turrets (see fig. 7) and observe that the range numbers are marked on the indexing plate of the front turret. Engage Range 1 (100-210kHz). Set the Line/Battery switch (at the rear left-hand corner of the chassis) to Battery. Connect a 6V supply (a. c. or d. c.) to the sockets marked Lamps. Turn the switch S3 by hand until the scale lamps kHz, x100 and the upper cursor lamp are illuminated. Disconnect the 6V supply and take care not to disturb the setting of S3 during the subsequent operations.

49 Stand the chassis on its rear face and slacken the two 4 B. A. screws that secure the switch S3 mounting bracket (reference 1 on fig. 7). Return the chassis to the horizontal position.

50 Remove the front panel assembly as follows:

(1) Remove the nuts that secure the Source and Detector B. N. C. sockets. This frees the plastic face of the front panel, which can then be lifted off. It is advisable to replace the nuts on the

B. N. C. sockets to prevent their falling into the attenuator assemblies.

(2) Remove the 6 B. A. screw at the top left-hand corner (as viewed from the front) of the meter sub-panel.

(3) Remove the six 2 B. A. countersunk screws, nuts and washers that secure the front panel assembly and carefully lay the panel face downwards on the bench. It will facilitate subsequent operations if the chassis assembly is raised on blocks approximately 1-2 inches above the bench; the front panel should rest on the bench, i. e. a little below the chassis.

51 It will be seen that of the five pillars that support the front bearing plate (now exposed) only one - that at the upper left-hand corner - passes through the range drive belt. Remove the five 2 B. A. bearing plate securing screws; if this is done carefully the plate will remain in position. The object now is to very carefully move the front bearing plate forward a small amount, sufficient only to slip the drive belt between the bearing plate and the front of the support pillar. With care, it is possible to do this without disengaging the gear spindles from their front bearings. As soon as the belt is over the pillar, replace and secure the 2 B. A. screws in the front bearing plate.

52 With the switch S3 mounting bracket at the right-hand extreme of its movement, slip the belt over the gear pulleys on S3 and the coil turret spindles, taking care not to disturb their relative settings. Move S3 mounting bracket until the belt is tight (i.e., the point at which all slack is just removed) and then tighten the 4 B. A. screws to secure the bracket.

53 Check the Frequency calibration as described in para. 53 and then re-assemble the front panel assembly by reversing the procedure given in para. 50.

54 <u>Tuning Drive Belt</u> Remove the chassis assembly as described in para. 47. Remove the front panel assembly as described in para. 50. In the case of the tuning drive belt, the front bearing plate must be removed completely (see para.50), leaving the five spindles (reference 3 in fig. 7) in place in their rear bearings. Release the old or broken belt from the cursor as shown in the inset to fig. 7.

55 Loosen, but do not remove, the 4 B. A. nut that secures the left-hand idler pulley (reference 2 in fig. 7). Drape the new belt over the gear cluster, making sure that all the spindles and bearing plate support pillars (except the pillar at the extreme lower left) are inside the loop of the belt. Mesh the belt on its drive pulley, then ease the spindles back into the appropriate bearings and engage the bearing plate on the support pillar spigots. Replace and tighten the five 2 B. A. screws that secure the bearing plate.

56 Loop the belt over the two idler pulleys at the left-hand side of the bearing plate (refer to fig. 7). Slide the adjustable pulley to the left until the belt is tight, i. e., to the point at which all slack is just removed; then tighten the 4 B. A. nut to secure the adjustable pulley.

57 Connect a 6V supply to operate the indicator lamps as described in para. 48. Set the Range switch to range 1 (100 - 210kHz). Turn the Tuning control to its maximum counter-clockwise position. Move the cursor by hand until the cursor line is set to exactly 1.0 on the upper scale. Lock the cursor to the belt (see inset to fig. 7). Check the frequency calibration as described in para. 58 and then re-assemble the front panel assembly by reversing the procedure given in para. 50.

Frequency Check

58 After replacement of either drive belt, check the frequency calibration as follows:

(1) With the SR268 switched on and set to Range 1, connect the Source output to the input of the Digital Counter (para. 31, item 3).

(2) Tune the SR268 until the Digital Counter indicates a frequency between the limits 99.5 and 100.5kHz.

(3) Observe the cursor indication on the SR268 tuning scale; if this is not 1.0 as exactly as can be observed, loosen the two 4 B. A. countersunk screws at the left-hand edge of the scale and slide the scale laterally until the indication is correct. Lock the two 4 B. A. screws to secure the scale.

TABLE 3

Typical D. C. Voltages

(Variations of up to ±10% must be accepted as normal)

SOURCE (Supply: 9V at 70mA)

Transr No.		11	12	13	14
Type		MM1941	ST70	ST70	ST73
Function		Power Amp.	Common Coll. Amp	Osc. O. P. Amp.	Osc
[1]DC Volts	e	1.3	1.7	4.4	1.5
	b	-1.8	2.5	5	2.2
	c	9.1	9	6.9	8.6
DC Curr (mA)		40	10	10	4.5
[2]AC Volts(p-p)	e	-	0.4	1.2	0.14
	b	-	0.5	1.2	-
	c	10	-	2.6	7.5
[3]O.P.Volts(p-p)		6dB			

DETECTOR (Supply: 9V at 50mA)

Transr No.		1	2	3	4	5	6	7	8	9	10
Type		ST73	ST70	ZT2708	ST70	ST70	ST70	ST70	ST70	ST70	ST70
Function		Com Base	Cascode Amplifier		const. curr. amp.	Feedback Pair		Feedback Pair		Feedback Pair	
[1]DC Volts	e	2.7	4.2	2.7	4.9	-	0.85	-	0.85	-	0.9
	b	3.3	4.8	3.1	5.6	0.8	1.6	0.8	1.6	0.8	1.6
	c	8.6	8.5	4.5	8.2	1.65	5.5	1.65	6.0	1.7	5.8
DC Curr (mA)		0.3	1	1	5	4	8	4	8	4	8
[2]AC Volts(p-p)	e	3μV*	-	-	-	-	-	-	-	-	-
	b	-	-	-	5mV	-	-	-	-	-	-
	c	-	20mV‡	-	-	10mV	-	100mV	10mV	1V	1V
[2]Nomnl Gain			60dB		-	20dB		20dB		20dB	

*Not Measured

‡Using x10 attenuator probe (7pF capacity)

Notes

1 Measured with respect to chassis (ht-ve) with 20kΩ/V multimeter on 10V and 2.5V ranges. The d. c. current drain figures are estimated, not measured.

2 Measured with respect to chassis with a Tektronix 585A oscilloscope and type 82 plug-in unit. f = 1MHz on Range 4 with 80dB input attenuator all in and approx. 30mV p-p input signal. Null meter reading 70% f. s. d.

3 With 75Ω load at the scope end of the cable. Measured as in Note 2, but with attenuator at 0dB, and x10 attenuator probe used for all measurements except O. P. volts.

LIST OF COMPONENTS

When ordering spare parts, please quote the Instrument Type and Serial Numbers, and the circuit reference and value of the required component.

Resistors, Fixed

Cct. Ref	Value	Tol. %	Rating	Manufacturer or I. S. Style
R1	360	±5%	1/10W	Erie Type EM1
R2	91			
R3	91			
R4	360			
R5	91			
R6	91			
R7	360			
R8	91			
R9	91			
R10	360			
R11	91			
R12	91			
R13	100			
R14	22k			
R15	6.8k			
R16	15k			
R17	100			
R18	22k			
R19	15k			
R20	6.8k			
R21	10k			
R22	2.2k			
R23	33			
R24	2.7k			
R25	6.8k			
R26	100			
R27	270			
R28	1k			
R29	A. I. C. *			
R30	1k			
R31	47			
R32	1.8k			
R33	390			
R34	100			
R35	22			
R36	1k			
R37	47			
R38	1.8k			
R39	390			
R40	100			

* A. I. C. = Adjusted in Calibration or value selected during manufacture. Replace with similar value.

Cct. Ref.	Value	Tol. %	Rating	Manufacturer or I. S. Style
R41	1k			
R42	47			
R43	1.8k			
R44	390			
R45	100			
R46	220			
R47	A.I.C. *			
R48	27			
R49	430			
R50	430			
R51	56			
R52	220			
R53	220	±5%	1/10W	Erie Type EM1
R54	110			
R55	140			
R56	140			
R57	360			
R58	91			
R59	91			
R60	22			
R61	180			
R62	2.7k			
R63	1.2k			
R64	1.8k			
R65	2.7k			
R66	110			
R67	220			
R68	100			
R69	330			
R70	1.5k			
R71	6.8k			
R72	4.7			
R73	1k			
R74	680			
R75	A.I.C.*			
R76	2.2k			
R77	5.6k			
R78	1.5k	±10%	1/4W	Style RC7-K
R79	6.8k			
R80	4.7			
R81	1k			
R82	680			
R83	A.I.C.*			
R84	2.2k			
R85	5.6k			

* See footnote following R40

Cct. Ref.	Value	Tol. %	Rating	Manufacturer or I. S. Style
R86	82	5%	1/10W	Erie Type EM1
R87	220	5%	1/10W	Erie Type EM1
R88	1k	5%	1/10W	Erie Type EM1
R89	22	10%	1/2W	Style RC7-H
R90	200	10%	1/10W	Morganite Type X
R91	47	10%	1/10W	Morganite Type X
R92	33	10%	1/10W	Morganite Type X
R93	5.6	5%	3W	Radio Spares W/W
Resistors, Variable				
RV1	560			
RV2	250			Plessey MP 'Dealer'
RV3	250			
Capacitors, Fixed				
C1	0.1	20	30V	Mullard C280AE P100K
C2	0.22	20	30V	Mullard C280AE P220K
C3	7-81p	Variable		Wingrove and Rogers C2-141
C4	1-5p	Preset		M. O. W.
C5	0.1	20	30V	Mullard C280AE P100K
C6	0.1	20	30V	Mullard C280AE P100K
C7	0.1	20	30V	Mullard C280AE P100K
C8	0.22	20	30V	Mullard C280AE P220K
C9	7-81p	Variable		Wingrove and Rogers C2-141
C10	1-5p	Preset		M. O. W.
C11	0.1	20	30V	Mullard C280AE P100K
C12	0.22	20	30V	Mullard C280AE P220K
C13	0.1	20	30V	Mullard C280AE P100K
C14	0.22	20	30V	Mullard C280AE P220K
C15	0.1	20	30V	Mullard C280AE P100K
C16	0.22	20	30V	Mullard C280AE P220K
C17	0.22	20	30V	Mullard C280AE P220K
C18	0.1	20	30V	Mullard C280AE P100K
C19	0.22	20	30V	Mullard C280AE P220K
C20	0.1	20	30V	Mullard C280AE P100K
C21	0.22	20	30V	Mullard C280AE P220K
C22	6.4	+50 -10	25V	Mullard C426AR F6.4
C23	0.1	20	30V	Mullard C280AE P100K
C24	0.22	20	30V	Mullard C280AE P220K
C25	0.22	20	30V	Mullard C280AE P220K
C26	0.1	20	30V	Mullard C280AE P100K
C27	7-81p	Variable		Wingrove and Rogers C2-141
C28	1-5p	Preset		M. O. W.
C29	25μ	+50 -10	25	Mullard C426AR F25
C30	25μ	+50 -10	25	Mullard C426AR F25

Cct. Ref	Value	Tol. %	Rating	Manufacturer or I. S. Style
C31	25μ	+50 -10	25	Mullard C426AR F25
C32	0.1	20	30V	Mullard C280AE P100K
C33	0.1	20	30V	Mullard C280AE P100K
C34	7-81p	Variable		Wingrove and Rogers C2-141
C35	1-5p	Preset		M. O. W.
C36	0.1	20	30V	Mullard C280AE P100K
C37	0.1	20	30V	Mullard C280AE P100K
C38	0.22	20	30V	Mullard C280AE P220K
C39	200	+100 -20	30V	Wima Printilyte
C40	25	+50 -10	25V	Mullard C426AR F25
C41	200	+100 -20	30V	Wima Printilyte
C42	25	+50 -10	25V	Mullard C426AR F25
C43	A. I. C. *			
C44	A. I. C. *			
C45	20p	10	350V	Lemco S. M. MS611/1
C46	39p	10	350V	Lemco S. M. MS611/1
C47	0.1	20	30V	Mullard C280AE P100K
C48	0.01	25	500V	Erie Disc Ceramic K7004/811
C49	0.01	25	500V	Erie Disc Ceramic K7004/811
C50	2000p	25	500V	Erie Disc Ceramic K7004/831
C51	2000p	25	500V	Erie Disc Ceramic K7004/831
C52	0.01	+80 -20	30V	Erie Microcap Ceramic
C53	0.01	+80 -20	30V	Erie Microcap Ceramic
C54	0.01	+80 -20	30V	Erie Microcap Ceramic
C55	0.1	20	30V	Mullard C280AE P100K

Diodes

Cct. Ref	Type	Manufacturer
MR1	AA119	Mullard
MR2	AA119	Mullard
MR3	AA119	Mullard
MR4	AA110	Mullard
MR5	OA47	Mullard
MR6	OA47	Mullard
MR7	1N916	Hughes
MR8	1N916	Hughes
MR9	1S920	Texas
MR10	1S920	Texas

WAYNE KERR SOURCE/DETECTOR SR268

Addendum to Maintenance Manual

Transistors type ST70 and ST73 are no longer available and, from instrument Serial No. 351 onwards, alternative types are used in association with the modifications detailed below. In the event of either ST70 or ST73 transistors failing in instruments prior to Serial No. 351, the alternative type must be fitted and modifications effected as shown below.

Transistor No.	Original Type	Replacement	Modifications
VT1	ST73	ME3002	Change C5 from 0.1μF to 0.22μF.
VT2	ST70	2N918	Clip 4th lead (Screen) off close to case. Wire 3 leads only.
VT3	ZT2708	2N2708	Join screen and emitter to same point.
VT4	ST70	2N2708	Join screen and collector to same point. Change C13 from 0.1μF to 0.22μF.
VT5	ST70	2N918	As VT2
VT6	ST70	2N918	As VT2
VT7	ST70	2N918	As VT2 and replace wire connection between C18 and VT7 by solder tag.
VT8	ST70	2N918	As VT2
VT9	ST70	2N918	As VT2
VT10	ST70	2N918	As VT2
VT11	MM1941	No Change	Free end of screen between VT11 and VT13 to be soldered to side of screening box by a single point at the top.
VT12	ST70	2N918	As VT2
VT13	ST70	2N918	As VT2, also free end of screen between VT11 and VT13 to be soldered to side of screening box by a single point at the top.
VT14	ST73	ME3002	NIL

Cct. Ref	Type	Manufacturer
MR11	1S920	Texas
MR12	1S920	Texas
MR13	1S2051A	Texas
MR14	1S920	Texas
MR15	1S920	Texas
MR16	1S920	Texas
MR17	1S920	Texas
MR18	1S2015A	Texas
Transistors		
VT1	ST73	Semiconductors Ltd
VT2	ST70	Semiconductors Ltd
VT3	ZT2708	Ferranti
VT4	ST70	Semiconductors Ltd
VT5	ST70	Semiconductors Ltd
VT6	ST70	Semiconductors Ltd
VT7	ST70	Semiconductors Ltd
VT8	ST70	Semiconductors Ltd
VT9	ST70	Semiconductors Ltd
VT10	ST70	Semiconductors Ltd
VT11	MM1941	Motorola
VT12	ST70	Semiconductors Ltd
VT13	ST70	Semiconductors Ltd
VT14	ST73	Semiconductors Ltd
VT15	40231	R. C. A.
VT16	40232	R. C. A.
VT17	2N3053	R. C. A.
VT18	40232	R. C. A.
VT19	40231	R. C. A.
VT20	40232	R. C. A.
VT21	2N3053	R. C. A.
VT22	40232	R. C. A.
Miscellaneous		
TH1	Thermistor	S. T. C. Type R14
TH2	Thermistor	S. T. C. Type A23
L1-L4	Choke	W. K. Dwg. D15252
T1, T4, T7, T8	C. M. R. Transformer	W. K. Dwg. D15080
T9	Power Transformer	W. K. Dwg. D15214
T2, T3, T5, T6, T10 to T41	Tuning Coils	See Table 1

Detector Power Supply

Circuit the same as part of Fig. 5 with changed reference numbers

R78	becomes	R70 (same value)
R79	"	R71
R80	"	R72
R81	"	R73
R82	"	R74
R83	"	R75
R84	"	R76
R85	"	R77
C41	"	C39
C42	"	C40
C49	"	C48
MR18	"	MR13 and Type Number (for both circuits) should read 1S2051A
VT19	"	VT15
VT20	"	VT16
VT21	"	VT17
VT22	"	VT18

On Fig. 5, BR1 comprises MR14, MR15, MR16 & MR17 and equivalent reference numbers for the Detector Power Supply, as BR2, comprises MR9, MR10, MR11 & MR12.

Also on Fig. 5, MR18 type should read 1S2051A.

List of Components, MR18, type should read 1S2051A.

MP MASTER
MA31203